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BULLETIN

American Congress on
SURVEYING AND MAPPING

Fourth Annual Meeting
WASHINGTON, D. C.—JUNE 3, 1944
Hotel Statler

THE EXECUTIVE COMMITTEE of the American Congress on Surveying and Mapping has set Saturday, June 3, as the date for the Fourth Annual Meeting of the Congress.

The meeting this year is more than the annual "get-together." It is a meeting of unusual importance to all members and others interested in surveying and mapping and related activities. The next year may bring many changes in world affairs and in the United States. It may well be a year of opportunity for the surveying and mapping profession. Also, the Congress may find itself in a position to help influence the planning and programming of surveying and mapping activities after the War.

At the Fourth Annual Meeting, it is proposed to consider and discuss the job ahead, including the planning of appropriate expansions of these activities as an aid to full employment during the adjustment period. An interesting program has been arranged which includes papers by prominent authorities in the fields of education, cartography, state planning, surveys and maps for cities, and private practice. The session will culminate in an informal dinner for which special entertainment has been arranged.

Further details of the program will be furnished the membership at a later date. You are urged to attend, and a cordial invitation is extended to your friends interested in surveying and mapping.

Mr. M. Y. Poling is Chairman of the Committee on Arrangements.

GEORGE D. WHITMORE, President.

"A Reconnaissance"

WALTER S. DIX, Cartographic Engineer

THE APPEAL for publication material in the January 1944 CONGRESS BULLETIN has set me to thinking. Why this dearth of material? Perhaps many of us engaged in surveying and mapping are too busy to devote much time or thought to the general interests of the American Congress on Surveying and Mapping. Perhaps some of us are apathetic. And perhaps there are many like myself who are not quite clear as to the full aims or policies of the Congress, and, with many thoughts or questions in their minds, have hesitated to mention them. Whatever the reason, it is an unhealthy condition for a new organization striving for recognition. It behooves each of us to do something about it, and not just wait for the other fellow to do it for us.

Perhaps that has been one trouble with surveying and mapping through the years—everyone has just taken it for granted. From my own experience it seems that engineering in general, the governments in general, and the public in general, have pushed surveying and mapping around with but little consideration or recognition. Perhaps many of us, having felt that way, followed the lead of an indignant few and joined what is now the American Congress on Surveying and Mapping.

In the recently published 16th Census of the United States *surveying* is classified as "and other semi-professional occupations." The effect of this may be far reaching. It may influence public, government, and professional opinion. No wonder that Professor Rayner said in the October 1943 BULLETIN, "Usually a practitioner prefers to be known as a civil engineer rather than as a land surveyor." And no wonder that Mr. Robert Randall said in the first BULLETIN, "Surveying and mapping have been too long everybody's business, and therefore nobody's business. Our Country and our profession have suffered in consequence."

Despite state registration laws and recognition by such an eminent body as the American Society of Civil Engineers, surveying and mapping may have a long struggle ahead before attaining the publicly recognized status of Medicine or Dentistry, for example. And good public support is important in such a fight as it is so many times the influence that gets things done when sheer reason and integrity fail. And apparently, we must be fully recognized by engineers in general before we can expect full public or governmental recognition. But no less important we must recognize ourselves!

Too many engineers associate the surveying and mapping profession with only their earliest endeavors in that field, for but few of them have

not dabbled in field surveys of some sort during student and early sub-professional days. And, consequently, many engineers graduate into professional status with the firm conviction that surveying and mapping is "leg work," to be done whenever possible by embryo engineers, students, sub-professionals, and possibly a few helpers. Certainly the skilled occupations of draftsmen, instrumentmen, etc., are not enhanced by this conviction; neither is the engineer's position. The medical profession is very careful not to encroach upon the fields of nursing or pharmacy, and it is conceivable that this mutual respect may in part account for the high public recognition they enjoy.

Articles in recent issues of Civil Engineering warn that unless groups recognize each other, and parent groups recognize their offspring, sooner or later the neglected ones will form alliances to further mutual objectives. The pro and con discussion in these articles brings out a very important point in organization policy—organization for purely technical advancement or for both technical advancement and economical well-being.

Obviously, if it is desirable to have a large membership extending in appeal to the total occupational fields of surveying and mapping, the policy and objectives should embrace both technical and economical advancement. And I would hazard a guess that a large membership with a definite purpose and liaison with closely associated groups, with good leadership and technical direction, and vigorous divisional and committee activity, could go far in accomplishing the objectives of the American Congress on Surveying and Mapping.

I mention liaison with closely associated groups, for I can think of no better means of acquainting engineers in general, and ultimately the public, with the importance of surveying and mapping to them. It is important that engineers in general know the value of basic mapping and surveying, but it is equally important that all branches of engineering support and encourage the specific objectives of surveying and mapping. In the February 1944 issue of Civil Engineering there is given a breakdown of membership in the 12 technical divisions—all basically interested in surveying and mapping—of the American Society of Civil Engineers. Of the 22,132 members only 1,438 are listed in the Surveying and Mapping Division. I sincerely hope there is a representative member of each of the other technical divisions among the 1,438.

Since public funds and approval must be secured in peacetime to carry on surveying and mapping activities, it is very important to educate the public, to show them that maps really don't just come from corner gasoline stations, that maps and surveys are based on other maps and surveys down to the basic surveys of the Nation, that it costs money to make the basic surveys, and that the cost is well invested, since surveys and maps are vital to the future of the Nation's enterprise and welfare.

In recent issues of some of our leading popular magazines, there have appeared very interesting articles and illustrations on modern map making. Most of these articles concern fast methods of military mapping, or the popular global pictorial cartography. These illustrated accounts have great public appeal and, incidentally, afford valuable publicity for surveying and mapping. Here, then, is an excellent means of securing public recognition. But one cardinal point should be borne in mind concerning pictorial publicity —the public must also be shown that certain maps and surveys are worthless unless there is a mathematical basis for them, and that there is a vast difference between a picture map and an engineering map. Another means of impressing the public—engineers in general, too—might be by simple but convincing statements like the following one quoted from a Pabst Postwar Employment Awards manuscript:

> To be sound in such planning and development it is obvious that good base engineering maps must be made available for study. It is of paramount importance that the United States be adequately mapped. This mapping means employment, as our Country is not adequately mapped. It will mean employment to keep it adequately mapped. Postwar mapping is a cardinal *must* plan, as all other broad plans require accurate study which always require accurate map information. Maps are always a must in war, and they are just as important in peace. Good maps mean good plans. Good plans mean good projects. Good projects mean employment.

Note particularly the statement, "Maps are always a must in war, and they are just as important in peace." The Military always consider surveying and mapping a must, and in time of war do have authorization and funds to prosecute urgent surveying and mapping projects. However, much of the physical struggle and difficulty that usually accompanies such emergency undertakings could be eliminated if adequate schedules of surveying and mapping were maintained during peacetime. But the funds necessary to carry on such work in times of peace are generally controlled from other sources. That is why it is desirable to have strong public support as good insurance, should sheer logic and reason fail. The strong voice of the public can produce magical results.

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RESOURCES FOR VICTORY MAP

A 20-by 26-inch map, in color, entitled Resources for Victory—A Geo-Economic Study, is available free from the Office of Inter-American Affairs, Washington, D. C. One side of the map shows the basic and secondary products of Central and South America; the other side shows certain physical and cultural features.

Maps and Surveys for Planning

RUSSELL VANNEST BLACK, Consultant in City Planning

MOST towns and cities are doing or will do a certain amount of over-all or comprehensive planning, as distinguished from project or individual-improvement planning. This kind of planning requires maps of character and scale not generally found in the smaller places and, often, not available even in the larger cities. Usually, the maps needed for over-all planning are equally useful for many other engineering and administrative purposes. And on the other hand, when maps and surveys are being made for other purposes, it may require only slight changes in form or scale to make them equally useful for planning. Preparation of the kind of maps outlined below will both expedite the planning process—when and if undertaken—and facilitate current engineering studies and decisions.

MAPS AND SURVEYS FOR OVER-ALL PLANNING

There are, of course, several stages of planning, with requirements in scale and precision ranging progressively upward as the planning develops from the "idea" stage to the official adoption and construction.

The "idea" stage—commonly known as over-all or comprehensive planning—is directed toward producing a master plan to guide public authority in placing and programming individual projects, and private developers in laying out land subdivisions and other improvements. Maps and surveys for general planning must be essentially accurate and must include all physical data necessary for solution of the local planning problem; but they need not have that precision and detail of engineering data required for making construction drawings or for locating individual projects on the ground. Likewise, maps for general planning purposes should be at much smaller scales than those required for construction plans.

Maps and surveys likely to be found most useful for over-all or general planning are as follows:

1. An Aerial Map or Mosaic
2. General Base Maps
3. Topographic Maps

1. *An Aerial Map or Mosaic.*—This map, which is a carefully spliced composite of individual aerial photographs, should contain all the area to be planned plus as much adjacent territory as can be included without making the map too large for convenient handling. It is desirable to have

this map in one piece; but, when dealing with large areas, it may be necessary, in keeping to a workable scale, to have it made in slightly over-lapping sections. The aerial map should be at the same scale as that used for making the general plan. In dealing with metropolitan areas, it is frequently desirable to make one plan at small scale showing the whole metropolitan area and another at larger scale showing only the central city and its immediate environs.

The aerial map is not very useful for urban planning purposes at scales smaller than 1 inch equals 1,000 feet and, usually, is not very practicable at scales larger than 1 inch equals 300 or 400 feet. If the aerial map is to be used, also, for preparation or revision of tax maps, it may be desirable to get an additional copy of it or a set of the individual photographs, at a scale especially appropriate to this purpose.

Within limitations, the aerial map can be given an accuracy of scale proportionate to the extent and accuracy of the ground controls by which it is assembled. For all general planning purposes, an error of not greater than 1 in 500, for scaled distances greater than 1 mile, is permissable. In mountainous terrain, where there is unavoidable photographic distortion, a somewhat greater tolerance may be allowed.

Most of the more settled parts of the country have been photographed within very recent years, either by private mapping concerns or by the Federal Government. Federal agencies have not yet undertaken to supply aerial mosaics, but they do supply individual prints which can be made into mosaics by mapping concerns specializing in this work. Whether or not sufficiently accurate mosaics can be produced by this means will depend largely upon the quality and flying specifications of the government-supplied photographs. It may be advisable, in some instances, to have a special flying job done to produce new photographs meeting local requirements.

Individual photographs enlarged to desired scale can be used for some planning purposes if a mosaic is unobtainable. But the mosaic is always more usable than a collection of individual prints, and for some purposes such as making new maps by direct tracing it is essential.

Planning uses of aerial maps and photographs include: (*a*) identification of land uses and the location and identification of structures and other physical features; (*b*) continuous reference and time-saving substitute for field investigations; (*c*) substitution for other more costly maps not available, and checking other maps for accuracy and completeness; and (*d*) reference in preparing or assembling other maps.

2. *General Base Maps.*—The planning process includes preparation of a number of existing-conditions maps and preparation of a general plan

map showing proposed improvements and development. When zoning is included in the planning program, special existing-use maps and a zoning map are added to the list.

All planning surveys and maps require, for adequate presentation, one or more base maps especially suitable for this purpose. These base maps, to start with, should not contain a great deal of detail. It may be sufficient to show only such features as existing streets and roads, railroads, principal waterways, and political boundary lines.

For general planning purposes, at least one base map should be drawn in one piece. The scale should be as large as is consistent with producing a one-piece map that can be handled conveniently. Difficulty in getting materials and direct reproductions make map widths greater than 54 inches generally impracticable. Scales smaller than 1 inch equals 800 feet are not practicable for most urban-planning purposes, and scales larger than 1 inch equals 300 or 400 feet are seldom necessary for over-all planning. When dealing with larger rural and semi-rural areas with broader planning indication—as for whole metropolitan or regional areas—smaller scale base maps, from 1 inch equals 1,000 feet to 1 inch equals 2,000 feet, are usually adequate.

Since planning maps are generally subject to a great deal of lay reading and interpretation, easily read and understood scales are important. Base map scales, therefore, should be expressed in multiples of 100's or 1,000's, rather than in ratios or in odd or fractional dimensions. It is believed that such simplification of scales is equally acceptable to most engineers dealing with urban problems.

As recommended for aerial maps, it may be found desirable when dealing with metropolitan areas or whole city regions to have two base maps, one at small scale showing the whole area and the other at larger scale showing the central city.

The required accuracy of the planning map should be about the same as that indicated for the aerial map. The map is to be used as an "idea" map and not for reading precise locations and dimensions of objects shown.

In the absence of more accurate maps or map data, the required base maps can be traced directly from the aerial mosaic. The photographic data must be supplemented, of course, by other recorded information such as right-of-way widths for streets and roads.

The usual procedure is to use facsimile reproductions of the planning base maps for showing various groups of existing-conditions data and for presenting planning studies, including the master plan and the zoning map. For successful facsimile reproduction, usually on tracing cloth, the base maps must be exceptionally well drawn. Much of the planning data to be added to the copies of the base map will have to be shown outside the street

lines; hence, to avoid confusion, street names should be either printed inside the street lines or omitted for the time being.

It probably will be necessary to reproduce some of the plan maps at much reduced scale. This requires special consideration in drafting the original base maps. It may be necessary to use some of the planning maps for educational purposes to gain public understanding and support of plan recommendations. For this reason the planning maps, from the base maps on through the whole series, must be more than merely legible. They should be impressive and, therefore, merit employment of the best available drafting talent.

When base maps to be used for planning are prepared for other purposes, perhaps more immediate, one or more tracing-cloth reproductions should be obtained before any special titles, legends, or other such information is added. The bare skeleton of the base map will best serve planning purposes which require their own special indications.

3. *Topographic Maps.*—The better the topographic base, the better the plan! The sometimes old U. S. Geological Survey mile-to-the-inch quadrangle maps, too often the only over-all topographic information available, are a pretty poor crutch for urban planning of even a most general nature. They have to be used when nothing else is available; but every effort should be made to expedite the making of more accurate and larger scale maps, especially for urban and metropolitan areas and other territory susceptible to intensive development. For general planning purposes, accuracy and amount of detail shown in topographic maps are more important than scale, although the latter should, preferably, not be less than 1 inch equals 2,000 feet. Where planning is extended to the more or less precise platting of new streets, the topographic map scale should not be less than 1 inch equals 400 feet, and topography should be shown at 2- or 5-foot intervals, depending upon the degree of slope.

Maps and Surveys for Advanced Planning

To put into effect the over-all plan or any part of it, much more precise maps and surveys are necessary, but the nature and quality of these maps and surveys are too well understood by practicing engineers to require more than passing notice here. Usually, they provide the groundwork for actual construction and are made as needed. Some, however, partake of a more general character and usefulness warranting advanced and more comprehensive handling.

We have already mentioned the usefulness of the precise topographic survey, valuable for many current engineering purposes in addition to

those of long-range planning. This survey and map should be made well in advance of actual construction, for at least all the developing or changing parts of an urban or metropolitan area. But, even before the topographic survey, there should be laid down a precise and close triangulation network into which all subsequent surveys, both private and public, can be precisely fitted. From the planning point of view, then, not the least value of such a network would be the further control over land subdivision thereby made possible.

Closely coupled with the topographic and triangulation surveys perhaps, but apt to be handled as a separate project, is the precise location and monumentation of streets and roads. Street widening proposals, the establishment of building set-back lines, and the administration of front-yard requirements are all dependent upon knowing the exact location of street and road right-of-way lines. Unfortunately, this information is not available in many of the smaller cities nor for the older sections of many of the larger cities. Getting it and pinning it down is another surveying job certain to be useful in carrying out a city plan.

The planning enabling legislation for some states provides for a second planning stage called "adoption of the official map." This map is comprised of existing public properties plus any features of the general or master plan that the city administration may elect to include. Showing a plan proposal, such as a new street, on the adopted "Official Map" has the effect of preventing all subsequent building encroachment within the mapped street lines. Obviously, to enforce such protection the location of all proposed changes must be precisely determined. This, however, involves more of the project-by-project surveying than of the over-all kind of mapping and surveying with which this article is chiefly concerned.

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PAN-AMERICAN MAP MAKING

ADDRESSING THE ENGINEERS Club of Baltimore, Rear Admiral Leo Otis Colbert, Director of the U. S. Coast and Geodetic Survey, explained the cooperative work of the various American nations in connection with map making. He said, "The announcement by President Roosevelt of the 'Good Neighbor' policy was followed shortly by some very practical applications of cooperation between the American republics. One of the projects in which the Survey has been able to contribute was a program arranged through the State Department for special scientific observations in Central and South America to obtain measurements of ocean tides, of gravity, and of geomagnetism."—*The Baltimore Engineer,* February 1944.

The Cleveland Regional Geodetic and Underground Surveys

*G. BROOKS EARNEST**

ONE of the most uniquely operated surveys in this country has been in execution in Cleveland, Ohio, for the past 7 years. Strange as it may seem, it was not the brain-child of an engineer but of a lawyer-councilman, Mr. E. J. Bohn, who, in 1937 became Director of the newly formed Cleveland Regional Association. In the studies made by this group, it was discovered that only about one-seventh of the area (in scattered sections) was mapped and this, at a scale of 1 inch equals 400 feet, by the County Sanitary Engineer. There was no unified survey control (horizontal or vertical). Survey data as expressed by the several governmental agencies were not in close agreement and there was no reliable base map of the county.

Conception of the Geodetic Survey

Through conferences with municipalities and federal agencies, it was obvious that a geodetic and topographic survey was a prerequisite for the proper planning of the physical structure of the city and county areas. Natural obstacles were foreseen in attempting to undertake such a survey under the financial and supervisory control of any one of the several governmental agencies in Cuyahoga County. Consequently, Mr. Bohn conceived the plan whereby the costs would be borne jointly by the several public agencies which would derive the most benefit therefrom, together with anticipated cooperation from the Works Progress Administration. The plan met with immediate approval. The following agencies cooperated in the project:

Ohio Department of Highways	Case School of Applied Science
County of Cuyahoga	U. S. Coast and Geodetic Survey
City of Cleveland	Ohio State University

Mr. A. J. Sweet, who had been associated with R. H. Randall and Company for a number of years in executing similar surveys, was appointed Director of the Survey. The Survey began operations July 12, 1937. In March 1941, Mr. Sweet (now a Lieut. Colonel, General Staff Corps) was granted an indefinite leave of absence, having been called to active duty in the Army.

* Associate Professor of Engineering Surveying, Case School of Applied Science, Cleveland, Ohio, and
Associate Director, Cleveland Regional Geodetic Survey.

Late in 1937, Mr. M. Y. Poling, Director of Engineering Surveys, Works Progress Administration, drafted the necessary project proposal for sponsorship of the Geodetic Survey. About a year later, Mr. Poling drafted the necessary project proposal for sponsorship of the Underground Survey. The sponsoring agencies provided the supervising personnel and the W.P.A. furnished the personnel in the lower employment brackets, as well as those necessary to perform the administrative work. The W.P.A. expended over $353,000 on the Geodetic Survey and over $421,000 on the Underground Survey. As of February 1, 1944, the above named sponsors (not including W.P.A.) have expended over $473,000 on the Geodetic Survey and over $136,000 on the Underground Survey. In addition, the sponsors are credited for space, truck, instrument and equipment rental in the amount of $47,400 for the Geodetic Survey and $23,600 for the Underground Survey. The fact that this joint sponsorship and cooperation plan has worked is the "unique" feature of the Survey.

One amazing fact has been in evidence from the start; i.e., although various sponsors have contra-political beliefs and a number of changes in administration have taken place, there is perfect unanimity in their desire to cooperate on this engineering project which has been adding materially to the conception, preliminary studies, design, and estimates for planning or construction in this region.

The Geodetic Survey provides control within Cuyahoga County; an area of approximately 450 square miles. Roughly, one-third of this area is within the bounds of the city of Cleveland. The built-up or urban area of the county includes approximately 130 square miles.

Specifications For Control

The specifications for the several orders of horizontal and vertical control as recommended in the American Society of Civil Engineers Manual No. 10, Technical Procedure for City Surveys, are adhered to with slight modifications where engineering economy does not dictate.

Triangulation Control

The triangulation reconnaissance in the urban area was facilitated by the use of the roofs of various buildings and this method also simplified reconnaissance in the rural areas. The present network consists of 119 triangulation stations. The average area controlled per station in the urban area is 2.4 square miles. In this area, there are 43 stations located on the roofs of buildings and 5 are ground stations. The average area controlled per station in the rural sections of the county is 3.9 square miles. There are 27 stations located on buildings and 44 are ground stations.

There are four Lake Survey triangulation stations in Cuyahoga County, all of which will be eventually pulled into the net. One of these stations, "Warrensville," is used as the origin of the coordinate system.

The heights of the ground station towers varied from 5½ to 70 feet. The heights of the towers constructed on the buildings varied from 3 to 36 feet.

In the early stages of the Survey, a test area containing approximately 56 square miles was established with two base lines and 24 triangulation stations. This net was observed and adjusted by least squares, thereby permitting traverse control to be executed together with a test plane table sheet. This enabled the sponsors and other interested parties to view the results of all the operations of the Survey.

The final network of triangulation is set up in two adjustments; one major adjustment which bounds approximately 228 square miles and an adjacent adjustment which bounds approximately 92 square miles.

The following results apply to the first major adjustment, which as yet has not been completed:

A. *Major Adjustment*

(a) No. of stations	56
(b) No. of directions	310
(c) No. of triangles	126
(d) No. of equations	156
Angle equations	100
Side equations	46
Length equations	5
Azimuth equations	5
(e) No. of base lines	5
Average length	2.63 miles
Average probable error	1:2,002,000
Maximum probable error	1:1,523,000
(f) Longest sight used as a direction	6.4 miles
(g) Shortest sight used as a direction	1.1 "
(h) Maximum triangle closure	3.87 sec.
(i) Average Triangle closure	1.58 sec.

B. *Supplementing the Major Adjustment*—and included within the same boundary.

(a) No. of stations	19
(b) No. of triangles	65

Supplementary Traverse Control

Azimuth and position transfers are made from the triangulation stations located on buildings or other structures, to pairs of permanent

ground monuments via quadrilateral or central-point figures. These bronze-capped precast concrete monuments, interspersed throughout the county, provide starting or closing points for the traverse control which supplements the triangulation. Additional pairs are placed at strategic locations in the traverse courses to facilitate the work of the engineer or surveyor when making ties to the horizontal control system. The average distance between the monuments in each pair is approximately 700 feet, and the pairs are spaced about 0.6 of a mile in the urban area and 0.8 of a mile in the rural area. To date, 1507 Cleveland Regional Geodetic Survey Official Monuments have been set, the majority of them being in pairs.

The specifications adopted for the traverse were in accordance with accepted standards for such control. The main lines, which extend from triangulation stations to junction points, are limited to a closing error of 1:35,000. These lines are held fixed. For the secondary lines the allowable closing error is 1:20,000.

As of February 1, 1944, the status of the traverse is as follows:

First-order traverse completed	441 miles
Additional angles observed	69 "
Additional reconnaissance completed	344 "

In order to provide adequate control for the topographic mapping, 57 miles of third-order traverse have been completed.

Levels

The leveling of the Survey consists of first- and second-order levels. The first-order levels were run at intervals of about two miles, north-south and east-west, and inside the first-order loops the second-order levels were spaced at intervals of approximately one mile. Wherever possible the level lines and the traverse courses are along the same streets and roads, and the same monuments are used for both traverse and levels. The first-order network was completed and adjusted by 1940.

The county was divided into 20 large circuits for the initial adjustment of the first-order levels, representing a total of 220 miles of levels. These circuits were further subdivided by first-order level lines, usually into four smaller loops. Loops were also added to the periphery of the original net. Next, these smaller loops were further subdivided by second-order level lines, usually into four smaller loops. In all there are 584 miles of first-order levels and, as of February 1, 1944, 544 miles of second-order levels.

The average loop closure in the initial level least squares adjustment was 0.025 foot with a maximum of 0.064 foot. For the smaller loops the average closure was 0.020 foot with a maximum of 0.063 foot.

Vertical Datum

Lake level had been the established datum for all engineering offices within Cuyahoga County, excepting the railroads and the State Highway Department. One reason for this was that a good Mean Sea Level datum had never been established. In 1940 the U. S. Coast and Geodetic Survey established a Mean Sea Level datum for Cleveland and, after the least squares adjustment of the first-order new level net, all elevations were computed on this datum. The city and county passed resolutions legislating the adoption of the new Mean Sea Level datum, and they are now in effect.

A bound mimeographed publication, giving the descriptions and elevations for all monuments on these first-order lines, was published and issued, free of charge, to the sponsors and other engineering offices in the county. Upon completion of the second-order levels, it is planned to re-edit the publication to include descriptions and elevations of the official monuments of the Cleveland Regional Geodetic Survey, the monuments placed by the sponsoring agencies, and the monuments of the U. S. Coast and Geodetic Survey and the U. S. Geological Survey.

Approximately 2,500 monuments are scattered throughout the 450 square miles, making it unnecessary to carry levels further than one-quarter mile on the main streets in the urban areas and one-half mile on the main roads in the rural areas.

Mapping

An average of four plane table parties have been mapping in the field since August 1940. These parties have been working in strategic areas where major Freeway programs exist. The recommended city survey mapping scale—1 inch equals 200 feet, with a 2-foot contour interval—is being used. The mapping is executed in strips ranging from 1,000 to 4,000 feet in width. Since this mapping is for the immediate and specific purpose of location and line design of the Freeway and Interchange System, considerably more culture is plotted than would be otherwise. All buildings and residences, excepting garages, are plotted in order to present requisite criterion for paper location to minimize condemnation proceedings. Accordingly, progress is decelerated and, as of February 1, 1944, only 10.7 square miles have been mapped. The plane table sheets are enlarged to 1 inch equals 100 feet by means of an ideograph or precision pantograph and the location of line design is based directly upon the physical data on these enlargements.

The Freeway and Interchange System—as an anticipated, complete, expanded program—is estimated to be a $150,000,000 project. This is just one of many which should be on the postwar planning program for a

city the size of Cleveland. Therefore, it is a natural presumption that the existing survey control in the Cleveland area, together with the existing plane table mapping, should save many years of preliminary survey time. Furthermore, the cost of obtaining this survey data has been jointly borne by those public agencies which, in all probability, will carry the lion's share of postwar construction activities.

Map Projection

The plane rectangular coordinate system is used for mapping. The plane is tangent near the center of the county. Since the county has a maximum dimension of 30 miles in the east-west direction and 24 miles in the north-south direction, no noticeable discrepancies should result by the use of this projection at the prescribed scale.

The (O, O) of the coordinate system is southwest of the southwest corner of the county. The easting of the west boundary is approximately 10,000 and the northing of the south boundary is approximately 8,000.

Equipment Innovations

Several new features in the way of equipment have been developed and used to considerable advantage on the Geodetic Survey.

Mounted red or green neon or fluorescent tubes, 4 feet long, have decidedly facilitated triangulation observing in the urban area where the myriad of white lights makes it difficult to find, in the theodolite scope, an ordinary signal lamp target of the U. S. Coast and Geodetic Survey type. The necessary transformers permit the use of the ordinary 110-volt city current or the 6-volt wet-cell automobile battery.

Two new equipment features were developed in the Department of Civil Engineering Laboratories of Case School of Applied Science, the Case taping buck and a device for calibrating tapes. The Case taping buck has a movable strip of stainless steel of tape thickness alongside of which the tape is stretched and the scratch on the tape brought to colineation with the scratch on the strip. The strip is then clamped. The strip is attached to a head which is also adjustable for line and rough distance. One leg of the buck is detachable at curb height with an inner pointed shoe which permits leveling the buck at curbs or in rough terrain.

The distinctive feature about the tape calibrating device is the employment of a micrometer in a system of precision ball bearings for obtaining precision readings on the base tape and the tape which is being calibrated.

A number of other unique features were employed in the construction of the traverse tripods, traverse rods, tent frames, signal lamps, and containers for transporting the survey equipment to the field.

Underground Survey

In January 1939, the Cleveland Regional Underground Survey was established with the Work Projects Administration contributing the major quantity of manpower. Since the withdrawal of the Work Projects Administration sponsorship, the State Highway Department has been carrying the burden of the sponsorship with the City of Cleveland assisting.

The Underground Survey force executes the necessary field and office work to produce accurate detail maps showing the horizontal and vertical locations of all existing public and private utilities, as well as the accurate street layout. The latter provides control data for the production of an accurate Wall Map of Cuyahoga County.

The so-called "Book Sheets," the final product of the Underground Survey, are at a scale of 1 inch equals 20 feet and are approximately 2 by 2½ feet in size. Over 600 of these cloth tracings have been completed as of February 1, 1944. In addition, 66 strip cloth tracings, each 2 by 5 feet, at a scale of 1 inch equals 20 feet have been completed and used extensively by the Water Department. Over 10,000 utility points (electric, gas, water, telephone, telegraph, and steam) are available for inspection at the Underground Survey Headquarters.

Cooperation With Coast and Geodetic Survey

In November 1943, the U. S. Coast and Geodetic Survey began observing on a triangulation chain on the 81°-30′ meridian, south from Cleveland. A tie-in was made to the four old Lake Survey stations and nine stations in the Cleveland net. They used five of their Bilby towers, ranging from 90 to 110 feet. At the remaining stations, they used the towers constructed by the Cleveland Regional Geodetic Survey. This cooperation on the part of the Coast Survey is greatly appreciated by the sponsors of the Cleveland Survey. The Coast Survey has recently expressed its willingness to provide horizontal and vertical control to cities devoid of such and which are planning large-scale postwar construction programs. This is a very commendable gesture on its part. The present global war is making many more individuals map-minded, therefore, the future should hold in store considerable impetus directed toward the revision of existing maps together with the mapping (undoubtedly by newly exploited means) of unmapped territories.

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Join the American Congress on Surveying and Mapping and Keep Abreast of the Profession

Radio Exploration for Buried Valleys*

PROF. R. C. HIGGY, Director, *WOSU* Broadcasting Station

RADIO has been used in geophysical exploration for many years, the literature reporting various methods of determining geologic structures through measurements of the behavior of radio signals. The objective in nearly all cases has been that of locating mineral or oil deposits and some success is indicated in the few available published reports. The general methods used appear simple but the interferences always present due to topography and near-surface variations make an exact interpretation of data difficult.

Radio waves are known to penetrate the ground only to relatively small distances, depending upon the frequency and the nature of the soil or rock encountered. This distance will vary from a few feet at high radio frequencies to hundreds of feet at the lower frequencies.

Radio surveys made several years ago for the purpose of determining the radio transmission characteristics of Ohio terrain revealed irregularities or changes in absorption often identified with geologic and topographic features. River valleys, and boundaries where two types of underlying rock structures were in contact, were encountered and reported in Bulletin No. 92 of the Engineering Experiment Station, Ohio State University. Subsequent field intensity surveys of broadcasting stations revealed irregularities clearly traced to pre-glacial river valleys now filled with glacial drift and not visible on the surface.

The State Water Board during the past few years has been mapping the pre-glacial river systems in Ohio. These rivers are a potential water supply source that it is believed will be of considerable value to industry in the future. With the natural water table falling in most areas, new reservoirs of water that these old river valleys provide will prove of importance in maintaining industries using large volumes of water. Most of the data obtained to date have been secured from well-drilling records, necessarily scattered and limited in number even in important areas. In searching for other methods of locating these glacial-buried valleys, the correlation of radio transmission characteristics with geologic conditions (referred to in Bulletin 92) was recalled and has been the subject of further study. This study, necessarily of a preliminary nature, was unfortunately interrupted by the war. Some measurements were made during the summer of 1942 that are of interest and show promise that this method may be successfully developed.

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*Reprinted through the courtesy of Engineering Experiment Station News, Ohio State University, December 1943.

It is now generally accepted that the strength of a ground wave radio signal is dependent upon the amount of absorption or attenuation of the wave by the ground over which the signal passes. In areas where this absorption is high the radio transmission conditions are poor and a considerable amount of energy may be extracted from the passing radio wave. From the results of surveys made in recent years this absorption has been determined and compared with soil conditions as well as topographic features and the underlying geologic structures. Fertile soils which contain a considerable amount of moisture have been found to absorb less energy from the passing radio wave than less fertile soils. Over hundreds of paths studied, this correlation of fertility and absorption has been striking and true without exception in both Ohio and Michigan. The less fertile sandy soil areas show very high absorption. This correlation with fertility is possibly associated with the moisture content of the soil but appears to be an excellent indication generally true. Hilly areas of eastern Ohio likewise show a considerably higher absorption factor than the level areas of western Ohio. Higher absorption has also been noted in the vicinity of rock boundaries or other irregularities of the bed rock structure.

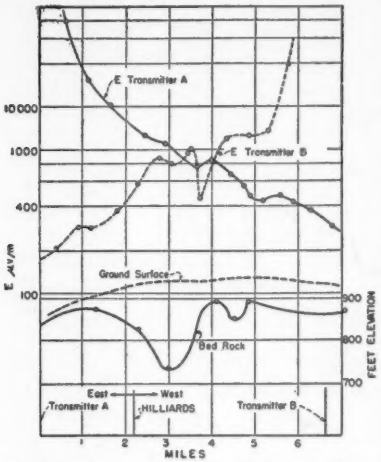

Fig. 1—Transmission along Hilliard's Road, 2398 kc, September 1942.

An interesting fact that was determined early in the course of this work is that the absorption is proportional to the amount or depth of glacial drift over bed rock. This fact suggested that irregularities in the surface of bed rock, in areas where the surface of the ground was level or nearly so, could be determined by noting the absorption present, an increase over a portion of the signal path denoting a greater distance to bed rock. Further study has revealed that this is only a partial explanation of what happens, and that reflection of the signal from the bed rock surface probably plays an important part also.

Figure 1 shows the results of measurements made in the vicinity of Hilliards, Ohio, a few miles northwest of Columbus. For these tests a portable radio transmitter was used at two locations, one east of a known

buried valley near Hilliards and one to the west. The elevations of both the ground surface and the bed rock were obtained from topographic maps and a few well-drilling records. Curves of radio field intensity made with a portable field intensity meter, from each transmitter location, show irregularities in the vicinity of the indicated valley. It will be noted that the irregularities do not occur in exactly the same position from both transmitters. This is possibly due to the different shapes of the two walls of the valley reflecting the signal to the surface at different locations to combine with that of the direct ray received from the transmitter along or above the surface of the ground.

This analysis suggests that over a very large valley it would be possible to secure standing waves or somewhat regular variations as one progresses laterally across the valley, due to the variation in length of the two paths and the phase difference of the two signals arriving at the point of measurement. This effect was actually observed (see fig. 2) over the old Newark river valley known to exist in the vicinity of Newark, Ohio. While little actual information as to the location or shape of this valley is available,

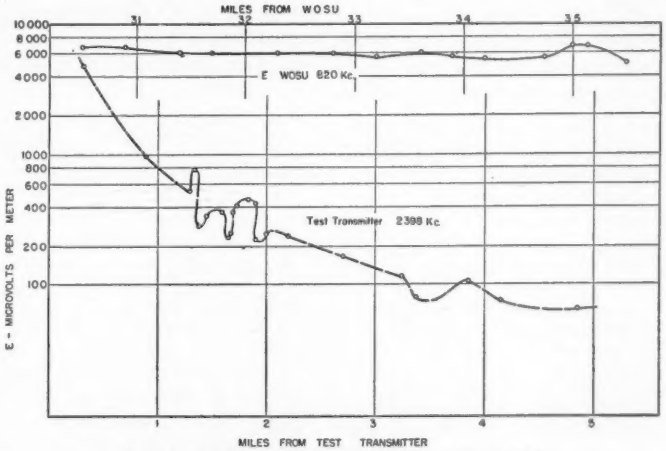

Fig. 2.—Southwest of Newark, Ohio, August 1942.

geologists have been able to map this valley from the topography of the area, and the data shown in figure 2 agree closely with the valley location. The small irregularity to the right on the field intensity curve was due to surface irregularities easily recognized.

These preliminary tests serve to show the complexity of the problem

encountered in radio exploration work and also show definite possibilities of securing worthwhile results. It has been encouraging to note that in every case studied to date, geologic irregularities are known to correspond with the radio measurements.

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MORE "INFORMATION PLEASE"!

THIS IS A STORY about a lawyer—a New Orleans lawyer—who called at a government agency to arrange a loan for his client. He was told the loan would be approved if title to the property was good and sufficient, so the lawyer returned home and sent a rather voluminous and accurate abstract of title by mail to the federal office. Soon afterward, the story goes, he received this letter: " . . . Your abstract clearly demonstrates that you are not without ample experience in this line of your profession. We have observed, however, that you have not chained the title back of the year 1803 and, before final approval can be accorded the application, it will be necessary that title be chained back of that year."

The attorney read the letter and his blood pressure shot up. He called his secretary and dictated this letter:

"Gentlemen: Your letter regarding titles in Case No. 198156 received. I note you wish titles to extend further than I have presented them. I was unaware that any educated man in the world failed to know that Louisiana was purchased by the United States from France in 1803.

"The title to the land was acquired by France by right of conquest from Spain. The land came into the possession of Spain by right of a discovery made in 1492 by a Spanish-Portuguese sailor named Christopher Columbus, who had been granted the privilege of seeking a new route to India by the then reigning monarch, Queen Isabella.

"The good Queen, being a pious woman and careful about titles took the precaution of securing the blessings of the Pope of Rome upon the voyage before she sold her jewels to help Columbus. Now, the Pope, as you know, is the emissary of Jesus Christ, who is the Son of God, and God, it is commonly accepted, made the world. Therefore, I believe it is safe to presume that He also made that part of the United States called Louisiana—and I hope to hell you're satisfied."

Jerry Kluttz, in *The Washington Post.*

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ASSOCIATE EDITOR FOR REGION 8

RANDALL N. SAUNDERS of Hollywood, California, has been designated Associate Editor of Region 8.

Maps for Municipal Use

HOWARD R. SAUNDERS, Vice President Region 8

MAPS are one of the necessary tools which the civil engineer must use in the design of all public improvements. Too often engineers are tempted to project major engineering undertakings without the essential data that might be made available by adequate and authoritative maps. One of the most important of these is the topographic map.

THE TOPOGRAPHIC BASE MAP

The compilation of a map, or series of maps from which rainfall and peak runoff data may be computed, offers one of the most fascinating problems to test the ingenuity of the trained cartographer. Topographic maps of this character are used for the design of storm-drain systems, furnishing essentially a picture, to scale, of the water shed to be served. In addition to this fundamental purpose, this series will serve as base maps for all Bureaus concerned with the progressive development of a municipality.

The purpose of this article is to point out the feasibility of obtaining such maps from information already at hand, since some of our fast growing municipalities have erroneously assumed that the preparation of such maps would be too costly an undertaking. The methods described here have been successfully used in the City of Los Angeles and qualified experts have been unanimous in their statement that the results attained have more than justified the undertaking.

It is very difficult to make a hard and fast rule regarding the best scale to use as cities vary greatly in size, and the topography varies considerably in different sections of the country. However, in making the base maps, there are two cardinal rules that should be followed:

1. All maps, to be of permanent value, must of necessity be based upon some system of control.[1]
2. All series of maps should be platted to scales that are definite multiples of each other. Such a system insures the greatest flexibility in filing and indexing. For example, the scales may be one inch equals fifty, one hundred, two hundred, four hundred, or eight hundred feet and still be platted on the same size sheet.

For a comparatively small area it is the usual practice to make topographic maps by the planetable method at a scale of 1 inch equals 100 feet.

[1] See Geodetic Control for City Surveys, Manual No. 10 of the American Society of Civil Engineers.

However, in municipalities of considerable area it is more practical to use a smaller scale because of the number of sheets involved. One inch equals 200 feet is a good average in such cases. In a city of large area, such as Los Angeles, which covers 450 square miles and where the topography varies from sea level to 5,000 feet above sea level, a scale of 1 inch equals 400 feet has been found the most satisfactory. This scale requires approximately 100 sheets, 30 by 40 inches in size, to cover the metropolitan area.

Data Available

Fortunately, maps drawn to a scale of 1 inch equals 100 feet or larger are one of the most fundamental needs of any municipality. These cadastral maps are used primarily for tax purposes and the issuing of licenses and permits of all kinds. Most cities have such maps, and whether based on geodetic control or not, they are generally plotted by rectangular coordinates and are accurate enough for reduction either photographically or pantographically.

If the area involved is first laid out on a system of rectangular coordinates and tied in with the United States Coast and Geodetic Survey network of control, it is a comparatively simple matter to run traverses around specified areas and close them within allowable limits. Most cadastral maps show centerline data and enough information to permit these computations without resorting to additional information. On the original drawings, which are platted on cloth-mounted paper, the coordinates of the street intersections are plotted and the pantographic reductions or tracings of the photo-reductions are transferred by means of graphite paper and a steel stylus.

In compiling the topographic maps for the City of Los Angeles, the planetable surveys (scale, 1 inch equals 2,000 feet) made by the United States Geological Survey, in cooperation with the County of Los Angeles, were used. By enlarging these photographically to the scale of the maps being compiled (1 inch equals 400 feet), the topographic details were traced on the same vellum sheets on which the street reductions had been shown. The topography was then transferred to the original drawing—the same as the streets were done—with graphite paper. Very little adjustment was necessary and the topography has been found remarkably accurate, considering the small scale of the original field work.

There are numerous areas throughout the country that have similarly benefitted by this cooperative arrangement with the Federal Government. These localities could compile such maps from existing data if they have not already secured topographic maps by the usual method.

After the streets and topographic features are compiled and inked on the original drawing, an ink tracing is made on tracing cloth of the street

openings only. A preliminary ozalid print is now obtained and becomes the working drawing for the compilation of the engineering data. From individual plans and profiles of storm drains, bridges, pedestrian subways, and all such structures, the plan numbers under which they are indexed, the catch basins, curb elevations, gutter-flow arrows, and all such data are neatly penciled in appropriate positions on this preliminary print. These data are then inked on the tracing, but not on the original drawing which is preserved as a base topographic map only. The tracing, after being thoroughly checked, is then completed by inking all of the street names and by tracing all of the contours from the original drawing.

Adaptation to Other Uses

A number of Bureaus, desiring to use these maps, found them too congested with engineering information. A second tracing was therefore made showing streets and contours only, leaving off the engineering data named above. By appropriate symbols, such cultural features as schools, street car lines, base house numbers, fire and police stations, libraries and institutions, and parks and playgrounds are shown. Some of the agencies benefitting through the use of these maps are the City Planning, Water and Power, Fire, Police, Playground, and Park Departments.

As a further experiment some of these topographic base maps have been reduced one half to a scale of 1 inch equals 800 feet, which maps, when bound in cover, form a convenient set for desk or counter use. In fact, the possibilities of this type of map have scarcely been touched, the most difficult problem being that of educating the various officials as to the advantages to be gained by all Bureaus adopting the same base maps.

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SURVEY OPERATIONS AT ENIWETOK

". . . Here again was America's answer to Japan. It took 2 years of preparation, but now the Japs found themselves up against a combined task force representing, for the first time in our history, all the armed services—Army, Navy, Air Force, Marines, Coast Guard, and Coast and Geodetic Survey. This last was brought along on our strike at Eniwetok as an extremely important adjunct in sweeping through reefs and making surveys of enemy waters."

—Hal O'Flaherty in the *Chicago Daily News.*

Survey at Munda*

CAPTAIN GEORGE T. FIELDING III, Field Artillery

WE LANDED on Rendova with the Division Artillery Commander, in the first infantry wave. My battalion survey section and I comprised an advance detail for our outfit, with instructions from the colonel to meet him when he arrived with the battalion the following morning and guide the batteries into the positions which, by then, we would have chosen and surveyed in. It all sounded so simple, and in my mind I had it all figured out. I had studied the maps of the landing area in detail, and knew just where I would go and what I would do, even to counting on knocking off work at precisely 1200 to munch on a "D" ration bar.

Well, it didn't work out that way. What I hadn't figured on was the Japs running around among the coconut trees on shore, shooting at us as we landed and, worse still, having possession of our gun position area-to-be. As my instructions did not include taking our area by storm, I thought it advisable to turn that matter over to the infantry, so we dumped our survey equipment on the beach to pitch in and help unload the swarm of lighters as they came racing in. Thus we initiated our survey operations on the New Georgia Islands—perhaps not the "school solution," but what could we do?

ESTABLISHING THE CONTROL

The survey problem was an interesting one from the beginning. Here were the usual large, volcanic, jungle-covered islands, surrounded by barrier reefs and small coral islands—an ideal set-up for triangulation. The difficulty in this case was that our target area, New Georgia proper, was 10,000 yards away and shielded from our view by its barrier reef and by several islands, large and small. No points affording unobstructed view of the mainland were immediately available.

My battalion of 155-mm howitzers arrived the following morning (we barely had time to get to Kokorana Island and choose and mark the battery areas, aside from even attempting any survey) and moved into position without incident. The Division Artillery survey officer established control in the position area, locating two points which gave us a known base for triangulating in nearby islands and OPs (Observation Posts), and enabled rapid extension of survey control. This was of much more immediate value to us than the time-honored "Point *A* and line *AB*," or one point and a line of direction.

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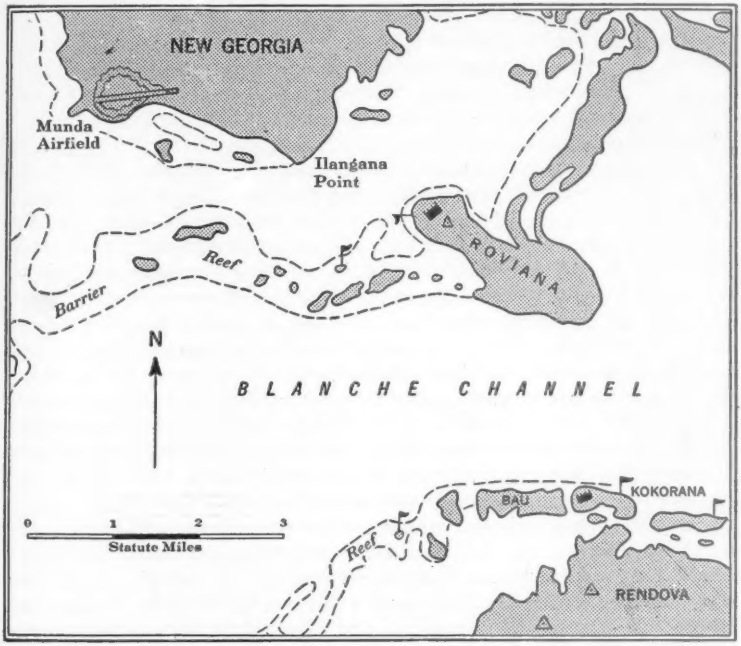
* Reprinted (in part) through the courtesy of the Field Artillery Journal, January 1944.

The battery sections tied in the guns, and our problem was to extend control to the New Georgia mainland. We decided to put in two widely separated points on our nearby barrier reef to use as ends of a long base. At least that was the plan, but even according to the supplemented TBA (Table of Basic Allowances) we didn't rate a motorized rubber boat or,



Sketch showing gun positions, OPs, and key survey points.

in fact, any kind of a boat. There we were on a tiny island 200 yards wide and 600 yards long, and the other end of our base a good 5,000 yards (and several islands) away. We finally found an old round-bottomed rowboat (which leaked a little), and in that we managed to get our work done, paddling some 6 miles on one occasion. Later we found a large rubber boat, minus outboard motor. We still have these two boats with us, carrying them faithfully wherever we go. Some day we hope to find an outboard motor.

When we did get up to both ends of our base, results were not satis-

factory. It was like trying to see a movie from behind a big hat. The view to the mainland proper was almost entirely obscured by the barrier islands in front of it, with only patches visible here and there. So we went through the preliminary step of locating the barrier islands accurately, and hoped from that to get a rough map correction, *K*.

Meanwhile, we had to be content with firing by air observers and by observers on a meager OP on a low hilltop which afforded some view of the mainland in the vicinity of the air strip. An observed fire chart was built up, and later on two better OPs were constructed in some jungle tree-tops. Even with a captured 20-power Jap BC scope (a Battery Commander binocular telescope) it was impossible to make out many details at this 13,000-yard range.

A photomap, an uncontrolled mosaic with the 600-yard JAN (Joint Army-Navy) grid, was used as the firing chart, and targets were assigned on it. Although we of the survey section were not satisfied with this arrangement, we had to bide our time until we could establish better control ourselves. Fortunately, most of the artillery fires at the time were "saturation fires," covering area targets; for these the photomap was sufficient.

While waiting to get more favorable OPs, we spent a few days making up a controlled map of Rendova and the surrounding smaller islands, whose coastline it was our secondary mission to defend in the event of enemy landings. We also carried control to other artillery units located on two islands 10,000 yards to the right front. Here we used a 1,400-yard short base (600 yards taped in knee-deep water), and we encountered some difficulty in seeing their marker. Although it was a white sheet 5 feet square, we couldn't pick it up in the transit until we went over and raised it to a height of 12 feet. Apparently the earth's surface does curve.

The advance of our infantry soon was forcing the enemy out of our already-strained range, and it was necessary for our battalion to displace forward to an island only 7,000 yards from Munda Airfield. Roviana was in the New Georgia barrier group, and afforded an almost unobstructed view of the field from its backbone hill. This was what we had been waiting for. The thoughtful placing of an undershirt on a palm tree during the preliminary reconnaissance enabled quick location of our new positions, and extension of control from there to our tree OPs and several islands to the flank was a simple matter.

Aerial Photographs

From that time on, the survey problem cleared up. We located a number of points in the target area and then a few aerial photographs began to filter down to the battalion. We took a strip of these verticals (1:5,000), determined the over-all scale of the carefully assembled strip

mosaic, and proceeded to grid it with a 1,000-yard artillery grid, matching the coordinates of our surveyed firing chart. The photo interpreters usually marked enemy installations on these photos—such things as bivouac areas, ammunition dumps, dual purpose guns, strong points, etc.—and locating these on our firing chart became merely a matter of reading the coordinate of the target on the photo and plotting it on the firing chart. Then, by registration on a check point (identifiable on photo), any number of accurate concentrations could be brought down on these targets by *K*-transfer, targets that could not be seen by our ground and sometimes even by our air observers.

We gridded the first set of photos by determining the scale (using known points), constructing a 1,000-yard grid at that scale on tracing paper, plotting in the control points on the overlay, and placing the paper on the photo so that the plotted points coincided with those on the photo. This oriented the grid, and it was transferred by pricking through the intersections on the photo and inking in the lines. Subsequent photos could be gridded by transferring the grid lines by inspection from the master set (picking out two identifiable points through which each line passed), or new targets could be transferred to the master (gridded) set of photos by inspection, and the coordinates so obtained.

Again we traced in the coastlines on our firing chart, based on the survey control points, and this gave us a dependable 1:20,000 map. Base angles were obtained by getting the difference between the surveyed (not measured) *Y*-azimuth of the orienting line and the computed *Y*-azimuth from the guns to the base point (from coordinates).

As far as an accurate firing chart was concerned, we were well set up and could execute unobserved fires on point or area targets with good effect. Admittedly, vertical control was not complete, but some control was present and we filled in with the contour lines taken from the Hasty Terrain Map. Our missions, however, were assigned by coordinates taken from the uncontrolled photomap, using the JAN grid, so it was necessary to superimpose the JAN grid onto our photos and firing chart as best we could.

Locating the Front Lines

Then we ran into the problem of locating the front lines. The infantry had been attempting to locate themselves in the jungle by inspection on their lithographed copies of the photomap, and artillery forward observers were trying to do the same. While this was fairly simple to do when following along the coastline, it was an almost impossible feat back in the hills, even for a photo expert.

The artillery had been locating the front lines every day to its own

satisfaction by plotting in the night protective barrages, which their observers adjusted in every afternoon as a countermeasure against enemy infiltration after dark. Nevertheless, more tangible data was asked for and we were told to "survey in (by traverse) the front lines." So out we went.

We drew the regiment on the right flank as ours to locate, and they were well back in the jungle. We surveyed up the twisting peep trail for over a mile (28 legs), trying hard to disregard the "crack," "crack" of the snipers' rifles from the green foliage on both sides. The phrase "aiming point this instrument" kept running through my mind as I watched the transit operator and the stadia man working, but I didn't feel it necessary to tell them so.

With half a mile still to go to reach the regimental CP, we ran into a road block that the Japs had just established. Several peep drivers and linemen tried to get through, but were ambushed and we were advised to wait until the situation cleared up. The trail was cut off there for 2 days. Soon thereafter the lines moved rapidly ahead and the idea of locating this regiment by traverse was abandoned. Other more accessible regiments were located by traverse, however, but they soon outdistanced the survey in their rapid advance on the airfield.

I like the panel location method. By using it and informing the infantry commanders of the exact map location of their panels, they are in turn able to orient themselves on the map and they have a starting point to refer to as they move forward. And then on one series of photos is a picture of the entire front lines, from one end to the other.

If the terrain at the front is open enough or high enough to permit any kind of observation, the forward observers may locate themselves by resection from known points on the map. While results may be approximate if a prismatic compass is used instead of an aiming circle or BC scope, they should, nevertheless, be satisfactory.

We attempted to furnish some forward observers with 1:5,000 photos of their sectors, to enable them to get a better picture of the ground and, when the photos were gridded, make it possible for them to report location of targets or their own location, by inspection. Once the jungle growth has been cleared away to some extent by artillery fire an observer can locate himself by inspection on a good photo, provided that it is a recent one (incessant artillery fire causes considerable changes in the appearance of wooded terrain on photos). Our efforts were only partially successful because of the difficulty in coordinating the procurement of sufficient copies of the photos, the gridding of them, and the placing of them in the hands of the forward observers.

The battalion continued to pour shells into the Jap lines from Roviana and gradually the spasmodic enemy bombing attacks slackened off and

their erratic counterbattery fire ceased. On August 5th we watched the final assault on the Munda Airfield from a grandstand seat on Bibilo Hill; the tanks and infantry stormed the last Jap positions in the middle of the airfield while the souvenir hunters closed in on the wrecked Jap planes on the edge of the field. The show was over.

Instrumental Equipment

Before closing I'd like to say a word about our survey instruments. The transit was found to be invaluable and was used almost exclusively in the target area survey, having the advantages of a strong power telescope (which enabled identification and location of distant and ill-defined points) as well as greater accuracy over the aiming circle. The aiming circle did come in very handy for measuring angles from the crotch of a tree where even a monkey could not set up a transit. The stereoscope and the illuminated magnifying glass were both worth their weight in gold in picking out surveyed points and targets on the aerial photographs. The range finder, on the other hand, was taken out of its case a few times, cleaned, and carefully put away again.

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"SIC TRANSIT"

The following is part of a routine report received by Mr. Felix W. Truss from a member of his field party.—Editor.

"Here is my statement as to how it happened that I fell in the creek and thereby ruined the transit:

The boys had set a turn across the creek, and to save myself a walk of about a mile, I looked at the creek, which is ordinarily very small, and decided I could save a half hour's time if I could wade it. There was the remains of an old corn field across the main channel with the short stalks sticking out over the water top. I concluded from this that the water was 2 or 3 feet deep at most. Got about three good steps into the water when my feet went out from under me, and there I was, with transit on my back, swimming for dear life. Swam about 15 or 20 feet to a bush, stopped, rested, and collected my thoughts. It was as far back as it was on across so I decided to go on. Almost made it with transit still dry, but it slipped off my shoulder and went under. If you want a tough job sometime, try swimming with a transit on your shoulder. The tripod is wood and wants to float. The head is metal and wants to sink. Just the opposite of what must be done to keep the thing dry."

Federal Surveying and Mapping Agencies

This is another in the series of sketches of the history, purpose, and scope of activities of federal agencies engaged in surveying and mapping.—EDITOR.

MISSISSIPPI RIVER COMMISSION*

WAR DEPARTMENT

THE NEED for improvement for navigation and flood control was generally recognized by the year 1879, and a bill was introduced in Congress providing for the creation of the "Mississippi River Commission." This Act provided for the appointment of a Commission for the improvement of the Mississippi River from the Head of Passes near the mouth of the river to its headwaters near Lake Itasca in Minnesota. Under the provisions of this Act the President of the United States by and with the advice and consent of the Senate appoints seven commissioners, three of whom are selected from the Engineer Corps of the Army, one from the U. S. Coast and Geodetic Survey, and three from civil life, two of whom must be civil engineers. As thus organized it was an executive body reporting to the Secretary of War.

The Flood Control Act of May 15, 1928, made certain changes in the organization and duties of the Mississippi River Commission. The responsibility for the prosecution of the work was placed upon the Chief of Engineers, U. S. Army. The President of the Commission became the executive officer reporting directly to the Chief of Engineers and responsible to him for the prosecution of the work. The headquarters of the Commission are at Vicksburg, Mississippi. The work is performed by three engineer districts with headquarters at Memphis, Vicksburg, and New Orleans, respectively. Under the 1928 Act the Commission itself ceased to be an executive body and became an advisory and consulting body only.

SCOPE OF ACTIVITY

As originally organized, the Commission was charged with the preparation of surveys, examinations, and investigations necessary to carry out the purposes of the Act; and it was also charged with the preparation and consideration of plans to improve the river channel, protect its banks, improve navigation, prevent destructive floods, and promote and facilitate commerce and the postal service. A proviso also required the commission

* Prepared in the Office of the President, Mississippi River Commission.

especially to consider the practicability of the various plans known as the jetty system, the levee system, and the outlet system as well as such other plans as the Commission might deem necessary.

In accordance with the general project, levees have been built along the Mississippi River and tributaries were authorized; revetments have been placed along the banks of the river to prevent excessive erosion; dredging has been performed from Cairo, Illinois, southwardly to provide for the authorized channel depths and widths for navigation; and cut-offs have been made in recent years to reduce flood heights and create a more suitable alignment of the river channel.

Methods of river engineering and construction have been evolved and improved, hydraulic dredging with dust-pan dredges developed as a method of channel maintenance, and exhaustive studies made looking toward the development of proper methods of flood control. A hydraulic and soils laboratory known as the "Waterways Experiment Station" was established at Vicksburg under the direct supervision of the President of the Commission. This station provides an agency for progressive and scientific experimentation by means of scale models. Models of various types are built and experiments and studies carried on for the solution of hydraulic problems.

Gauges are maintained on the Mississippi River and its tributaries, and daily stages are read and recorded, and published in pamphlet form at the end of the year. Discharge measurements are made as required and the observations together with daily discharges are published.

Surveys and Maps

An accurate survey of the river was of first importance and the Commission decided on a geodetic survey with triangulation and precise levels of a high degree of accuracy from the headwaters of the river to the Head of Passes near the Gulf of Mexico. Observations for longitude, latitude, and azimuth were made at suitable intervals along the triangulation system; base lines were measured and reduced to sea level; shorelines of the river banks with detailed topography were located showing the configuration of the ground with 5-foot contours, as well as all roads, buildings, character of vegetation, kind of timber, etc.; and soundings were taken across the river at frequent intervals on lines normal to the flow of the stream. Under this general survey, maps were accurately prepared on 1:10,000 scale and published in sheets on 1:10,000 or 1:20,000 scale as necessary to show the entire Mississippi River.[1]

[1] The charts covering the river from Cairo, Ill., to its headwaters at Lake Itasca, Minn., have been transferred to the Upper Mississippi Valley Division, St. Louis, Missouri, and are no longer issued by the Commission.

The flood control plan adopted in 1928 also provided for a topographic survey of the entire Alluvial Valley of the Mississippi River southwardly from Cape Girardeau, Missouri. The primary purpose of this mapping was to provide complete, reliable, and uniform data of the Alluvial Valley for use in general layout and coordination of the flood control project. Each quadrangle was prepared on a polyconic projection, and printed in colors at a scale of 1 :62,500, to cover 15 minutes in latitude and 15 minutes in longitude or about 250 square miles. Two hundred thirty quadrangles were prepared, of which 30 were made by the U. S. Geological Survey and 200 by the Commission. The original project was completed in record time. The entire Alluvial Valley of the Mississippi River was mapped, with topography showing all improvements and with a 5-foot contour interval where practicable. All the work was referred to the North American datum of 1927, and elevations were based on Sea or Gulf level. In preparing the maps standard symbols adopted by the then Federal Board of Surveys and Maps together with symbols published in Training Regulations, U. S. Army, were used. All of the maps prepared by the Commission were made from aerial photographs using single lens cameras with the airplane flying at an altitude that would produce photographs on a 1 :10,000 or 1 :12,000 scale.

The Commission also publishes maps of the river, showing channels and navigation lights, and maps (in colors) showing the early stream channels in periods from 1765 to 1941. Both of these series are at a scale of 1 :62,500 and cover the river from Cairo, Ill., to the Gulf of Mexico.

In connection with the field work, means and methods were introduced by the Memphis, Vicksburg, and New Orleans District Engineers that greatly increased the rate of progress and reduced the costs without decreasing the accuracy of the results. Topography in the Memphis Engineer District was obtained through the use of elevated truck mounts for planetable operations. The observer worked on a truck under canvas cover while the rodman rode in a light car to secure the necessary ground elevations by stadia method and contours were sketched directly on the aerial photographs. It is believed that this was the first time trucks were used for this purpose.

Much of the Atchafalaya Basin, due to its marshy condition, could not be traversed by any vehicle except a boat, and in preparing maps of that area it was essential to locate geodetic positions on the aerial photographs to control their position for mapping purposes. To obtain these required data, four towers with an instrument height of 116 feet were erected at selected positions and geodetically located. For the purpose of tying in aerial photographs, points were selected on the picture and then located by means of instrumental intersection on a portable steel tower erected over

the desired position. The tower was mounted on a small barge and towed through the bayous to the predetermined location.

Due to the constantly changing river conditions, changes in flood control plans, and new roads and various local improvements, the maps and charts require general revision periodically by the Commission. While new and up to date when originally published, it has been necessary to print revised editions at about five-year intervals. Maps and charts made and published by the Commission are intended primarily for use in connection with flood control operations, but the public or commercial firms also use them for many purposes. Every effort is made to produce suitable and accurate, up-to-date maps at an economical price.

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COMMISSIONS FOR HYDROGRAPHIC OFFICERS

THE UNITED STATES NAVY is interested in commissioning additional men as Hydrographic Officers. These men will be assigned to surveying duties on a fleet survey vessel or as Cartographic Officers on an auxiliary vessel or with amphibious units.

A college degree in civil engineering and 2 years of experience in one or more of the following fields is desired: hydrographic or geodetic surveying; land and topographic surveying or mapping; city surveys or mapping, preferably with triangulation experience; construction surveys; plotting on maps or charts or working up field notes of survey parties. In the absence of a degree, applicants should have 2 years in an accredited college of engineering, plus 4 years of practical experience in one or more of the fields listed, in addition to some transit or theodolite experience. A knowledge of piloting and navigation would be a valuable additional qualification.

The age bracket is 25 to 40. Applications should be made to the Office of Naval Officer Procurement, 33 Pine Street, New York 5, N. Y., or to other procurement offices in principal cities.—*Civil Engineering,* April 1944.

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A NEW SURVEY of the Canadian Northwest may be undertaken jointly by the Canadian Government and the railways. Such a survey is needed, especially now that means of communication cover a vast area which even today is not covered by reliable and up-to-date maps.

—From the *Ottawa Citizen.*

Use of Coordinates in Police Work

COLONEL BEVERLY OBER, Superintendent, Maryland State Police

ONE of the many lessons which may be carried over from war experience to peacetime application is the use of plane rectangular coordinates for designating the location of map positions. Maryland has used such a grid system successfully in connection with national defense activities and is now in a position to take advantage of the fact that all State troopers have been given instruction in the coordinate system and that much of the preliminary work has been done.

It has long been recognized that one of the great difficulties in responding to emergency calls or in deploying a force of men to cover a given situation and guard against escape of criminals lies in not being able to give or receive concise directions or to specify designated points so that there is a minimum danger of confusion and misunderstanding. In the military, this problem has been solved by gridding the map in a system of squares, from which the coordinates of a given point may be quickly read and reported and the exact location of the point identified by the receiver. In civil practice we are still fumbling with confused directions, referring to little known landmarks and using local names which may have no meaning to the one who is trying to get from the jumble of words some idea of where he is expected to go. A constant source of danger is that the trooper, fearing to appear dumb, jumps to conclusions, and hoping he understands, rushes off to the wrong place. In contrast, if both men have before them a coordinated map, it is perfectly simple to say, for example, "Go to bridge at 1269-425 and stop 1940 black Ford sedan, license number Maryland 462-104," and there is no question as to what bridge is meant. The order is given without elaborate directions because the map supplies all the information needed to show how to get there in the shortest possible time.

Although the adaptation of the system to police work is far from complete, sufficient experience has been gained to see clearly the way ahead, and the Maryland State Police is now engaged in making the system more effective.

At Police Headquarters there is a large mosaic map of the entire State, at a scale of 1 inch equals 1 mile, and each of the nine police barracks is equipped with a similar map covering the section of the State in which it is located. State troopers, however, are provided with handy, small-scale, folding maps—state maps at a scale of 1 inch equals 6 miles—because they cannot carry large-scale maps of the entire State in their individual two-way radio cars. All of these maps are laid out with a grid based upon the State System of Plane Coordinates authorized by act of the Maryland

Legislature. This conforms with a legally recognized system which is fundamentally accurate enough for the most exacting use that will ever be demanded of it, and eliminates, therefore, fear of changes ever being necessary in the future. One advantage of using an authorized system of coordinates is that the coordinate lines on any one map will agree absolutely with those on any other map, regardless of scale.

Using this coordinate system as an authoritative basis, the Maryland State Police has compiled a comprehensive card catalog, giving the coordinates of 5,000 to 6,000 place-names in the State. Although most of the data was taken from the recent Gazetteer published by the State Planning Commission, the locations were checked by actual examination of detailed maps. Furthermore, there are several hundred names in the catalog for which there are no descriptions or locations in the Gazetteer, which fact makes this catalog the most nearly complete collection of geographic names in the State.

The combination of the card catalog, the two-way radio, and the portable map equips each trooper in the field with the equivalent of the most comprehensive gazetteer and the most detailed map. For example, even though some little community were not important enough to be shown on the detailed quadrangle sheets of the U. S. Geological Survey, should a motorist ask where such a community was located, the trooper could radio for coordinates and, in the course of a few minutes, point to the exact spot on his field map.

The map used at present is an emergency make-shift, but the State Roads Commission is working on a new map which will be more satisfactory in many respects. A portion covering one police district has been completed as an experiment for field trial, and reports on it have been very encouraging.

Use by Other Agencies

A distinct step forward was taken when the Department of Forests and Parks adopted the same system for reporting forest fires. Now both foresters and police have a common language to use in the many cases in which they work together.

Still another important contribution was the initiative of the Baltimore and Ohio Railroad in cataloging the coordinates of all milestones, stations, bridges, and tunnels; this precaution enables the railroad police to transmit to the State Police the location of any accident or crime. The State Police working with the Internal Security can now concentrate, wherever needed, the protective forces so necessary in war to guard munitions. Other railroads in the State have recently joined this movement to secure complete coverage in this respect.

One county has undertaken to popularize the use of the coordinate system to the extent of including it in the high school curriculum. If successful, this system may well become the common map language of the people. Coordinated maps are being made available to the public and, as more people understand them, it is entirely possible that those living in rural districts will soon learn that a 7-digit number identifies their homes and enables anyone with a map to find them. Obviously, much time can be saved if, when making an emergency call, the distressed house owner has confidence that this number means more to the police, the Fire Department, or the ambulance driver than any amount of directions he can give over the telephone.

As yet, no steps have been taken to issue these numbers, but already their practicability has been demonstrated in describing the location of airplane accidents, particularly when these happen in out-of-the-way places. It is believed that, as incidents occur in which this "common language" among citizens, police, and cooperating agencies is a factor in bringing aid more quickly to the scene, this movement will receive added impetus.

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AERIAL PHOTOGRAPHY IN AIRPORT SELECTION

USE OF AERIAL PHOTOGRAPHY in the selection of airport sites is enthusiastically recommended by Fred Grieme, chief of the Civil Aeronautics Administration Airport Development Section, after tests conducted at some 25 CAA airport construction jobs had demonstrated the value of such a method. By the interpretation of aerial photographs alone, it can be determined what the soil texture of a particular area is, whether clay, silt, sand, or gravel, and whether its natural drainage is good, poor, or nonexistent. These two factors are vital to the choice of an airport site which will not require expensive fill initially or rebuilding of unstable runways later.

Approximately $150,000 was saved by use of aerial photographs at one CAA airport project, according to Grieme. Estimates had indicated that it would be necessary to pay a high price to bring gravel to the airport site, until study of photographs showed that there was a large deposit beneath the surface on a nearby farm. The owner believed that the CAA representatives were crazy when they made an offer for the gravel pit which he didn't know existed on his farm. A little digging confirmed their assumption.—*American Aviation,* February 15, 1944.

Women in Surveying and Mapping

A. O. Quinn, Tennessee Valley Authority

TODAY industry is depending to a considerable extent upon the ability of women to carry on important war production assignments. Ever since the early beginnings of woman suffrage, women have fought for equal wage-earning rights with men. Now, that demand is being met, and the need for women to take production jobs or training for specialized work is enormous. Industry is not alone in the use of women; professional positions also require highly skilled persons to replace the men who have entered the armed forces. The major agencies engaged in surveying and mapping have employed women within the last 2 years to perform a wide variety of professional and sub-professional work, such as drafting, editing, inspecting, mosaic building, computing, map compilation, printing, and many other similar positions.

The immediate use of women in the surveying and mapping profession has been greatly impeded by a tendency on the part of the colleges not to encourage women to take courses in science, mathematics, and mechanical drawing, which might lead to engineering pursuits. This apathy was largely based upon the difficulty in placing women graduates in positions where they could make use of "men's courses." The result has been that employers have had to provide training courses to assist women graduates in making the transition from their college training to the problems of surveying and mapping. Fortunately, the leading colleges have now recognized the need for giving their students better preparation in mathematics, science, and drawing; and the outlook for more and better qualified women candidates is most encouraging.

It was observed that women who have been trained to think precisely and to follow problems to a positive solution could readily absorb specialized training in surveying and mapping. College work providing various phases of art, drawing, and sketching served to single out a large number of persons who could be trained to fill drafting positions. Other graduates who had never encountered any work related to surveying and mapping frequently discovered a native interest in maps, and a latent ability to learn drafting or computing when told the details of the profession.

Women recruited for surveying and mapping are of course not confined to college graduates, but are to be found in a wide variety of activities. Previous work requiring hand coordination and skill, such as playing a piano or violin, retouching photographs and negatives, and art work have proven valuable assets in developing capable draftsmen. Aptitude tests to discover interests and potentialities are most helpful in placing women who have always thought, "I'd never have a chance to do that kind of work."

Training for Surveying and Mapping

Numerous means have been inaugurated to create an interest in surveying and mapping and to provide preliminary training. Some agencies have devised courses in map making and drafting which have been introduced in various colleges to selected students. The satisfactory completion of the special course and the regular college curriculum assures the student employment with the agency. Other employers have discussed their problems with a few colleges relying upon the institution to stimulate interest and to foster desired courses. Vocational schools in the large cities have designed courses in drafting, photo interpretation, and map reading; and Engineering Science Management War Training courses have been effectively utilized. The vocational schools and ESMWT have been most influential in giving a large number of working people an opportunity to fully explore positions which previously had been inaccessible to them: jewelry clerks have become draftsmen; school teachers, computers; artists, mosaic builders; and home economists, multiplex operators.

Employing agencies cannot expect brief outside training programs to completely orient women for detailed technical or semi-technical work. In view of the manpower demand, most people are unwilling to undergo training at their own expense when competition for their services enables them to obtain jobs and to be paid while being trained. Consequently, individuals are hired as trainees and given pre-assignment or orientation training after being placed on the pay roll. To meet present-day production demands, "streamlined" training must be given.

Recent experience has shown that women who are to be assigned to technical positions in map compilation, computing, and cartography, should be given some overall training in surveying and mapping as applied to the program of the particular agency. Women with mathematical or scientific background are most easily adapted to such work. Training should include actual field and office experience. Three months is not too long to spend in this training, during which time special aptitudes can be discovered that will facilitate their proper placement. Every effort should be made to thoroughly demonstrate each operation and to coordinate its place with the program as a whole. In the writer's experience most women seem a bit slow in grasping an appreciation of topographic features. Assignments as topographic rodmen and planetable operators on specially staked hillsides, and the stereoscopic examination of aerial photographs showing areas to be visited in the field, together with the completion of topographic drafting samples have been found most helpful in clarifying this problem.

Candidates for map-drafting positions should be given a more specialized mapping training with particular emphasis on drafting techniques and the use of map-drafting instruments. Problems in map reading, map symbols,

scale, projections, interpretation of aerial photographs, map compilation, and specific mapping practices used by the agency should be given in addition to supervised drafting exercises in lettering, straight-line and topographic work. Drafting does lend itself to demonstrating the old adage, "Practice makes perfect."

Employment Problems

Recruiting women for surveying and mapping presents many unusual problems. At present the competition for college trained women is exceedingly great, and frequently industrial concerns are able to offer higher salaries and more "glamour" than those agencies engaged in mapping alone. Then, too, it is necessary to "sell" women on the idea of accepting opportunities in engineering work. Another problem that has been encountered is the apparent timidity of women when faced with the idea of moving into a new locality. Interviews usually bring forth a barrage of questions regarding the place of employment, living conditions, the number of miles from their home town, etc.—men usually ask, "What is the job?" Home town opportunities are greater than in normal times, and many girls find that their parents offer serious objection to their leaving home. Daughter might think the position has unlimited opportunities—but would daddy let his loved one go so far from home?

A careful coordination with college officials and placement officers prior to any actual interviews has proven very successful in making basic qualifications known, and weeding out those candidates who are not particularly suited to technical work or to social environments away from home.

After employment, the first problem encountered where women must work beside men is the reaction of the men. There is, at first, mild if unexpressed resentment of woman's encroachment on what has heretofore been considered to be "man's sphere." However, this soon seems to wear off and the problem largely solves itself.

Generally, the problems revolve around interest in the job, loyalty, absenteeism, and turnover. Management must be constantly on the alert to effectively combat boredom and the need for diversion—these of course are problems for men as well as women.

Time lost due to sickness diminishes in proportion to the effectiveness of health and medical service furnished. Education in healthful living and prompt attention to all symptoms decreases the habit of using all available "sick leave."

It is not advisable to employ married women with children unless certain and adequate provision has been made to care for their children. Frequently, after the employer has spent months and substantial sums in training, women leave on scant notice to join husbands at an army post,

leaving the employer with a sense of frustration and a poor estimate of feminine responsibility. Included in this same category are the single girls who marry and leave before the employer can realize any value from the training investment. But it is futile to rail. One should smile, congratulate, and plan for the day when hubby goes overseas, and they may come back.

The Maps and Surveys Division of the Tennessee Valley Authority has been employing and training women for work as draftsmen, computers, cartographers, and photogrammetrists since March 1942. Since that time 230 women have been employed, of which 185 are college women, mostly graduates. At the present time 15 are in professional positions. In 2 years 57, or about 25 percent, have left the Division, the predominating reasons being: (1) to join husband who is in the armed forces, (2) to get married, and (3) to return home. A few have left to take other war jobs or to join the armed services. Only 5 left because they couldn't handle the job.

As far as the work is concerned, the feminine employees have done an excellent job. They have enthusiastically completed the training programs and performed all assigned tasks. They are particularly skillful in detailed drafting and map compilation. Some are being used in map editing. It has not been necessary to use women in field positions, but it is believed they could satisfactorily handle certain field jobs, if needed.

Postwar Probabilities

Wartime employment has made it clear that women can succeed in technical work. At the present time and in postwar time what is needed from management is a friendly cooperative attitude toward women who are engineers and those who desire to become engineers. The question may well be asked as to the probability of large numbers of women being trained and working as engineers after the war. The writer doubts it. The call of the home will still be with us, and the investment of time and effort involved in a complete engineering education is greater than is warranted by the relatively brief space during which the average girl works between the end of her school days and the beginning of married life. There are some successful women engineers who have made this work their life careers. This group will undoubtedly increase in the future, but probably will not amount to a very large proportion of the professional surveyors and map makers.

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REMEMBER THE ANNUAL MEETING—JUNE 3—WASHINGTON, D. C.

Surveying and Mapping News

Members are requested to send in surveying and mapping news items for publication in the BULLETIN.—EDITOR.

CURRENT SURVEYING AND MAPPING LITERATURE

MAGAZINE ARTICLES

AUSTRALIAN MAP MAKERS. Cecil Verdon Quinlan, *The Australian Surveyor*, September, 1943.

THE USE OF THE ANEROID BAROMETER FOR DETERMINING HEIGHTS. Eric D. Mellor, *The Australian Surveyor*, September 1943.

AN UNRECORDED BLAEU WORLD MAP OF C. 1618. Edward Heawood, *The Geographical Journal* (London), October 1943.

SEVENTEENTH-CENTURY DUTCH CHARTS OF THE EAST INDIES. G. R. Crone, *The Geographical Journal* (London), November-December 1943.

DESERT NAVIGATION. W. B. Kennedy Shaw, *The Geographical Journal* (London), November-December 1943. (Experiences of the Long Range Desert Group in the interior of Libya. Sand sailor uses essentially the same methods as deep-sea mariner.)

FIELD NOTES. Paul P. Rice, *New Jersey Engineer*, January 1944. (To be reprinted in a later issue of the *Bulletin*.)

THREE EYED MAPPING. Curtis Fuller, *Flying*, January 1944. (A discussion of the development and use of tri-metrogon mapping.)

SCIENCE—STUDY OF INVARIABLES. Oliver S. Reading, *American Scientist*, January 1944. (Includes a brief account of the development of aerial photography and its present-day applications.)

SURVEYS ENGINEER IN THE TROPICS. Robert Thistlethwaite, *The Canadian Surveyor*, January 1944.

BRIEF HISTORY OF THE MEASURE OF THE TERRESTRIAL GLOBE, (Continued). Althéod Tremblay, *The Canadian Surveyor*, January 1944.

THE NOMENCLATURE AND CLASSIFICATION OF MAP PROJECTIONS. L. P. Lee, *Empire Survey Review*, January 1944.

LAND TENURE IN CANADA. F. H. Peters, *Empire Survey Review*, January 1944. (Describes the cadastre (legal survey) in each of the nine provinces of the Dominion.)

THE LIFE OF A SURVEYOR IN JAMAICA. H. F. Edwards, *Empire Survey Review*, January 1944.

THE WATCHMAKER AND THE SCIENTIST—AN ALMOST FORGOTTEN CONTROVERSY. J. M. Sheehan, *United States Naval Institute Proceedings*, February 1944. (To be reprinted in a later issue of the *Bulletin*.)

CROSS HAIR ADJUSTMENTS OF INSTRUMENTS. David H. Crater, *Engineering News-Record*, February 10, 1944. (Illustrates difference in directions of movement between erecting and inverting telescopes.)

ENGINEERING EDUCATION IN WAR AND AFTER. Ivan C. Crawford, *Engineering News-Record*, February 28, 1944.

PERSPECTIVE MAPS. *Life*, February 28, 1944. (A popular account of the preparation and use of "Harrison" maps prepared from photographs of globes.)

TOPOGRAPHIC MAPPING IN THE REDWOODS. Chalmer K. Lyman, *The Military Engineer*, March 1944. (To be reprinted in a later issue of the *Bulletin*.)

ADJUSTING TRAVERSES ON PLANE GRID SYSTEMS. Russel I. Boyce, *Engineering News-Record*, March 9, 1944. (A modification of the usual method results in greater accuracy.)

OUR LOPSIDED EARTH. Erwin Raisz, *The Journal of Geography*, March 1944. (Describes unevenness of global distribution of geographical features.)

BOOKS

THE ORIGINAL INSTRUCTIONS GOVERNING THE PUBLIC LAND SURVEYS OF IOWA. J. S. Dodds, Editor-in-Chief. *The Iowa Engineering Society*, Des Moines, Iowa. 580 pp. $5.00. (In addition to much land survey information, the book includes eight sets of General Instructions published between 1831 and 1855 and approximately 1,000 letters of specific instructions written by the Surveyor General to the Deputy Surveyors.)

ELEMENTS OF AERIAL PHOTOGRAMMETRY. Earl Church. *Syracuse University Press*, Syracuse, N. Y. February 1944. 95 pp. $2.00. (Contains fundamental principles of photogrammetry and practical mapping methods including an 11-page chapter on trimetrogon mapping.)

MILITARY MAPS AND AIR PHOTOGRAPHS. A. K. Lobeck and Wentworth J. Tellington. *McGraw-Hill*, New York. First edition. March 1944. 256 pp. $3.50.

MAPS AND HOW TO UNDERSTAND THEM. *Consolidated Vultee Aircraft Corporation*, New York. Second edition. July 1943. 32 pp. (A popular description of the various types of projections in relation to their uses for air and sea navigation. 54 figures.)

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SECOND CONSULTATION ON CARTOGRAPHY

AT THE TIME of the first "Consultation on Geodesy, Aeronautical Charts, and Topographic Maps," an account of which was given in the January 1944 issue of the BULLETIN, the Brazilian Government through its representatives issued an invitation for a second Consultation, to be held in 1944 in Rio de Janeiro. This invitation has recently been confirmed by official action of the National Council on Geography, acting on behalf of the Brazilian Government. The program will include discussion sessions, to be held from August 15 to 26, followed by tours in Brazil, which will conclude September 2.

Those attending will be members of the Commission on Cartography of the Pan American Institute of Geography and History, and other representative cartographers, from all of the American nations. Discussion will be continued on the matters considered in the first Consultation, and it is expected that further progress toward unification of standards, improvement of technical methods, etc., will be made.

THE CANADIAN INSTITUTE OF SURVEYING

THE THIRTY-SEVENTH ANNUAL MEETING of the Canadian Institute of Surveying was held at Ottawa, Canada, on February 2 and 3, 1944. Representatives were present from all Provincial Surveyors' Associations, from the American Society of Photogrammetry, from the Federal and Provincial Government Departments, and from industries concerned with the development of Canada's natural resources. The meeting was in the nature of an open forum discussion on "Requirements of Aerial Photography in the Postwar Development of Canada's Natural Resources."

As an introduction to the discussion, a paper on "Aerial Photography as a Map Substitute" was presented by Mr. Louis A. Woodward of the Soil Conservation Service, U. S. Department of Agriculture. He said the great value of aerial photographs is that once an aerial survey has been completed and suitable negatives made available, aerial photographs to almost any desired scale may be quickly and cheaply reproduced for the geologist, drainage engineer, forester, soil scientist, and others.

The following were elected officers of the Institute for 1944-45: President—H. E. Beresford; First Vice President—R. D. Davidson; Second Vice President—A. O. Gorman; Secretary-Treasurer—W. L. MacIlquham.

STATE BUREAU OF SURVEYS AND MAPS

ON FEBRUARY 24, 1944 the Mohawk-Hudson Section of the American Society of Civil Engineers sponsored an informal discussion meeting at Albany, New York, for the purpose of promoting a State Bureau of Surveys and Maps. The meeting was attended by representatives from many engineering organizations throughout New York State.

Although New York State has legally established the State Plane Coordinate System, there has been very little use made of it. A need is evident, therefore, for a central agency within the State from which information may be secured and by which an educational program may be initiated. There are many areas within the State where additional control monuments are needed. The extension of the federal control network throughout the State would be greatly facilitated through coordination of survey work by a central agency such as proposed. These are only a few of the functions of such an agency which were discussed at length during the meeting.

A committee, headed by Mr. G. R. Shaw of Rensselaer Polytechnic Institute, was named to further the program initiated by this meeting.

—G.R.S.

CONGRESS NEWS

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COMMANDER BORDEN HEADS NEW COMMITTEE ON PUBLICATIONS

IN ORDER THAT the work of editing our enlarged BULLETIN may be facilitated, it has been deemed advisable to create at this time a new Committee on Publications. This Committee will have a two-fold purpose: (1) to procure suitable material for publication and (2) to develop a publication policy and deal with the problems relating thereto. Commander Frank S. Borden, Chief of the Chart Division of the Coast and Geodetic Survey has accepted the chairmanship of this Committee on which the Editor of the BULLETIN will be an ex officio member. Additional members will be designated from the various fields of surveying and mapping (both public and private), thus insuring a wide variety of publication material, as well as a diversity of viewpoint. All members are requested to cooperate fully with Commander Borden.

Material for publication may include any article, technical or non-technical, that deals with some phase of surveying and mapping, or closely related subject. Of particular value are descriptions of new methods and new techniques; short cuts, new developments in instrumental equipment; and personal experiences on difficult or unusual survey projects.

Suitable material need not always be original compositions. Probably many members have in their files interesting old clippings, letters, strange property descriptions, oddities in title deeds, poems or quotations dealing with surveying or mapping, etc., all of which will be gratefully received by the Committee on Publications.

GEORGE D. WHITMORE, President.

A TECHNICAL DIVISION ON LAND SURVEYING

BY RECENT ACTION of the Executive Committee, the feasibility of activating a technical division on land surveying, provided in the By-Laws, is to be investigated. This has previously been known as "private practitioner," but it has been suggested by many that the name be changed to Division on Land Surveying. The first step will be a poll of the membership, to determine how many are interested. Mr. S. A. Bauer, prominent

engineer and surveyor of Cleveland, Ohio, has accepted the Chairmanship of a pro tem committee to conduct the poll. If enough interest is shown, the Division will then be established on a permanent basis.

—G.D.W.

PUBLICITY FOR THE CONGRESS

From H. R. Saunders, Vice President Region 8, comes the following suggestion for gaining additional publicity for the Congress:

As the BULLETIN continues to improve it has occurred to me that what we need now is more publicity regarding it. With this in mind, I have furnished a copy of all back numbers of the BULLETIN to the Los Angeles Public Library with the request that it list in its semi-monthly prospectus items which it considers of interest. It seems to me it would be a good plan for each Regional Vice President to send copies of the BULLETIN to the main library in each of the larger cities.

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Obituaries

FRANK M. JOHNSON, widely known cadastral engineer, died in Denver, Colorado, March 27, 1944, after 49 years of continuous Government service.

Born in Clarke, Virginia, November 4, 1872, he received his education at George Washington University. After a brief period as surveyor's clerk in the Geological Survey, he became clerk in the General Land Office in 1899. In 1911 he was sent to Denver as supervisor of surveys and there he developed the present Cadastral Engineering Service, which encompasses 13 public survey offices in the Western States and Alaska. He was the author of the General Land Office publication, "The Public Land System of the United States." Mr. Johnson was the first Vice President of Region 7 of the American Congress on Surveying and Mapping.

When first announcement of his death was received in Washington, Secretary of the Interior Harold L. Ickes paid him the following tribute:

"The death of Mr. Johnson is a distinct loss to the Government which he served so long and so well. Not only was he recognized as an outstanding authority on public land matters, but the skill and painstaking care with which he installed in 1911 and supervised until the time of his death the Government's Cadastral Engineering Service, will stand as a lasting monument to his memory."

ARTHUR NOACK, well-known New Jersey Engineer, died on December 31, 1943. He was born in Statten, Germany, in 1881 and received his engineering education in Berlin. After passing the government examinations in engineering and land surveying, he came to the United States in 1903 and entered the employ of Wise and Watson, Passaic, N. J., as engineer and surveyor. He was Municipal Engineer for a number of cities and townships in New Jersey, including East Patterson, New Milford, Midland Township, Saddle River Township, and Lodi Township, as well as Consulting Engineer for many other townships, boroughs, and municipalities. Mr. Noack was a charter member of the New Jersey Society of Professional Engineers and its President in 1932.

NEW MEMBERS

NOTE:—The publication of the complete roster of members has been postponed awaiting the full returns from the membership. Those who have not yet mailed in the information cards are urged to do so immediately. —EDITOR

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